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Northrop Grumman Systems Corporation

2015 ANNUAL SUMMARY REPORT

Operation, Maintenance, and Monitoring Report for the Bethpage Park Soil Gas Containment System

Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003A

March 25, 2016

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NYSDEC ID # 1-30-003A

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March 25, 2016

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CONTENTS

TABLES

FIGURES

2015 ANNUAL SUMMARY REPORT
Operable Unit 3 (Former Grumman Settling Ponds)
Bethpage, New York
NYSDEC ID # 1-30-003A

1 INTRODUCTION

Pursuant to the Administrative Order on Consent (AOC) Index #W1-0018-04-01 (New York State Department of Environmental Conservation [NYSDEC] 2005) and the Operable Unit 3 (OU3) Record of Decision (NYSDEC 2013), ARCADIS of New York, Inc. (ARCADIS), on behalf of Northrop Grumman Systems Corporation (Northrop Grumman), has prepared this OU3 Bethpage Park Soil Gas Containment System (BPSGCS) Annual Summary Report for submittal to the NYSDEC. The present-day Bethpage Community Park property (Park), the McKay Field, and Plant 24 Access Road, which the NYSDEC has termed the "Former Grumman Settling Ponds Area" and designated as OU3, are referred to herein as the Site Area. Figure 1 provides a Site Area location map.

The BPSGCS (previously referred to as the Soil Gas Interim Remedial Measure [IRM]) has operated since February 18, 2008. The operation, maintenance, and monitoring (OM&M) activities performed during 2015 (i.e., January 1 through December 31, 2015 [the "annual reporting period"]) are summarized in this Annual Summary Report. The OM&M activities performed during the fourth quarter of 2015 (i.e., October 1 through December 31, 2015 [the "fourth quarter reporting period"]) are included in the summary of the annual reporting period. Data summaries for the previous three 2015 operational quarterly periods are available in the following letter reports:

- Results of First Quarter 2015 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, May 2015 (Arcadis 2015b)
- Results of Second Quarter 2015 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, August 2015 (Arcadis 2015c)
- Results of Third Quarter 2015 Operation and Monitoring for the Bethpage Park Soil Gas Containment System, November 2015 (Arcadis 2015d)

During 2015, the BPSGCS system OM&M was conducted in accordance with the NYSDEC-approved OU3 Soil Gas IRM OM&M Manual (Arcadis 2009a) and the NYSDEC-approved Sampling and Analysis Plan (SAP) (Arcadis 2008).

As discussed in the OU3 Site Area Remedial Investigation Report (Site Area RI Report; Arcadis 2011b), Northrop Grumman does not take responsibility for certain compounds (e.g., Freon 12 and Freon 22) present in the Site Area. Throughout this report, a distinction is made between the "Project" and "Non-project" volatile organic compounds (VOCs), which are defined as follows:

- Project VOCs: VOCs that may be related to former Northrop Grumman historical activities. For this report, Project VOCs include 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.
- Non-project VOCs: VOCs, such as Freon 12 and Freon 22, which are understood to be unrelated to former Northrop Grumman activities but have been detected in the Site Area. As noted in the Site Area RI Report (Arcadis 2011), a groundwater sub-plume of Freon 22 has been identified originating

from the area of the Town of Oyster Bay's (Town's) former ice rink. Based on Town information (Zervos 2007), Freon 22 was used by the Town and released to the environment.

2 BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM OBJECTIVES

The remedial action objectives (RAOs) of the BPSGCS are as follows:

- To mitigate the off-site migration of Project VOCs in the on-site soil gas through the implementation of a soil gas containment system installed along the Plant 24 Access Road and McKay Field Access Road, south and west of the Park, respectively, and;
- To comply with applicable NYSDEC Standards, Criteria, and Guidelines (SCGs)

The compliance objectives of the BPSGCS are as follows:

- To mitigate the off-site migration of soil gas, the system was designed to maintain -0.1 inch of water column (iwc) within a negative pressure curtain established within the vadose zone along the Plant 24 Access Road and along the McKay Field Access Road, from the boundary of the Plant 24 Access Road to approximately 400 feet north along the MacKay Field Access Road, based on a 12-month rolling average.
- To treat extracted vapors until it is demonstrated that all VOCs in the influent (untreated) vapor stream are present at concentrations lower than the NYSDEC Division of Air Resources Guide-1 (DAR-1) Annual Guidance Concentrations (AGCs) on a 12-month rolling average and Short-Term Guidance Concentrations (SGCs) for any given grab sample (NYSDEC 2014). On December 29, 2008, NYSDEC approved removal of vapor phase treatment (NYSDEC 2008).
- To collect and transfer condensate to the Nassau County Department of Public Works (NCDPW) sanitary sewer, in accordance with the requirements set forth by the NCDPW (NCDPW 2007, 2008) or dispose off-site at a NYSDEC-permitted disposal facility. The sanitary sewer ultimately discharges to the Town of Oyster Bay's Cedar Creek treatment facility.

3 BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM DESCRIPTION

Following review and approval of the Soil Gas IRM 95% Design Report and Design Drawings by the NYSDEC (Arcadis 2007b), the design package was finalized and the BPSGCS constructed. A general site plan (Figure 2) shows the treatment building, which houses the major process equipment, including two 20-horsepower [hp] and one 30 hp regenerative-type depressurization blowers, three 52-gallon moisture separators and associated transfer pumps. Remaining system components are located outside the treatment building and include one 33-foot tall by 16-inch diameter stack, the heat exchanger, the 18 depressurization wells, and the 47 induced vacuum monitoring wells, also shown on Figure 2. Monitoring well vacuum measurements collected during 2015 are also provided on Figure 2. A process flow diagram

that shows sampling and monitoring locations is provided as Figure 3. A detailed description of the system and a complete set of record drawings are provided in the OM&M Manual (Arcadis 2009a).

4 OPERATION AND MAINTENANCE ACTIVITIES

The following subsections provide a summary of the routine and non-routine operation and maintenance (O&M) activities completed during the annual reporting period to meet requirements outlined in the OM&M Manual (Arcadis 2009a), as well as a performance evaluation of the BPSGCS. Finally, overall conclusions and recommendations regarding O&M for the Site are included in this section.

4.1 Summary of O&M Completed During the Annual Reporting Period

The O&M of the BPSGCS was conducted in accordance with the OM&M Manual (Arcadis 2009a). This consisted of the following:

- Continuous monitoring by the Supervisory Control and Data Acquisition (SCADA) system.
- Weekly site checks to monitor and record key process parameters to confirm proper system operation, to assess whether a process parameter is changing or is out of range, and to provide information that may be helpful later in case there is an operation problem.
- Quarterly monitoring events to monitor and record key process parameters, including induced vacuums, to confirm proper system operation, make adjustments as needed, and to collect compliance samples. A summary of the quarterly monitoring data collected for the BPSGCS is provided in Tables 1, 2, 3 and 4.
- Routine maintenance of equipment was generally performed in accordance with the manufacturers' specifications as needed. This included annual alarm testing to confirm proper function of all advisory and system alarms.
- Non-routine maintenance of equipment and system components in response to alarm conditions or system parameters operating outside of their normal operating ranges. The most notable non-routine maintenance activities during the annual reporting period were due to minor system modifications, repairs and power anomalies. These conditions did not have a significant impact on system performance and have been proactively addressed to minimize system downtime.

4.2 Performance Evaluation

The OU3 BPSGCS operated continuously during the annual reporting period with the exception of brief shutdown events for routine and non-routine system maintenance. An operational summary of the depressurization wells, monitoring wells, flow rates and vacuums for the annual reporting period is provided in Tables 1 and 2. In summary:

- The system operated during the annual reporting period for approximately 358 days out of a total 365 days (approximately 98% uptime).
- During the annual reporting period, it was not necessary to complete condensate disposal. As of 2015, condensate removal is only conducted periodically by manipulating manifold vacuums and flow rates for brief periods of time. This process does not entirely vacate the below grade lines of condensate, though it enables the system to maintain adequate flow and vacuum at the manifolds without requiring a vacuum truck and a full day shutdown event.

4.3 Conclusions and Recommendations for O&M

The O&M activities conducted during the annual reporting period met the requirements of the O&M Manual.

5 MONITORING

The following subsections provide a summary of the monitoring completed during the annual reporting period to meet requirements outlined in the OM&M Manual (Arcadis 2009a). The following subsections also provide summaries of 2015 monitoring data, comparisons of the results with applicable AGCs and SGC's, and additional data evaluations describing the performance effectiveness of the OU3 BPSGCS. Finally, overall conclusions and recommendations regarding monitoring for the Site are included.

5.1 Summary of Monitoring Completed

In general, the monitoring of the OU3 BPSGCS was completed in accordance with the OU3 BPSGCS OM&M Manual (Arcadis 2009a). A summary of the monitoring completed during this annual reporting period is provided below:

- Quarterly system performance monitoring:
  - Instantaneous vacuum measurements at compliance measurement points and system operating measurements at influent manifolds, blower inlet and outlet, and system effluent were collected to assess the system performance. Summaries of the measurements are provided in Tables 1 and 2.
- Quarterly system compliance monitoring:
  - Containment system air quality monitoring was completed to monitor the performance of the containment system and to compare the levels to applicable AGC's and SGC's. Summaries of the results are provided in Tables 3, 4, 5 and 6.

5.2 Summary of Monitoring Results

5.2.1 Containment System Performance Monitoring

5.2.1.1 Annual Reporting Period System Operating Parameters

System operating parameters measured during the annual reporting period are summarized in Tables 1 and 2. Overall throughout the annual reporting period, the system components generally operated within their recommended ranges.

5.2.1.2 Vapor Samples

The total effluent screening level vapor samples (i.e., photoionization detector [PID] reading) measured during the fourth quarter reporting period and the annual reporting period are provided in Table 1. The screening results throughout the annual reporting period ranged from 0.0 parts per million by volume (ppmv) (March, September, and December 2015) to 0.2 ppmv (June 2015), which is consistent with historic data.

5.2.2 Containment System Compliance Monitoring

5.2.2.1 System Operating Parameters

Instantaneous vacuum measurements in compliance monitoring wells from the fourth quarter reporting period and annual time-weighted rolling averages are summarized in Table 2. Quarterly vacuum measurement data from the annual reporting period are also shown on Figure 2.

As shown on Table 2, during the annual reporting period, the instantaneous induced vacuum at all compliance-related monitoring points met or exceeded the minimum performance standard (greater than or equal to -0.1 iwc), with the exceptions of VMWC-7A, VMWC-7B, and VMWC-18A. Although instantaneous induced vacuum measurements at VMWC-7A, VMWC-7B, and VMWC-18A were slightly lower than -0.1 iwc in September and December 2015, the annual time-weighted rolling average of induced vacuum readings at all compliance-related monitoring points were maintained at greater than or equal to -0.1 iwc, demonstrating that the BPSGCS is operating as designed.

5.2.2.2 Vapor Sample

Effluent vapor samples were collected on a quarterly basis throughout the annual reporting period. As shown in the laboratory results in Tables 3, 4, and 6, the total volatile organic compound (TVOC) concentrations ranged from 630 micrograms per cubic meter ($\mu g/m^3$) in December 2015 to 1,530 $\mu g/m^3$ in June 2015. The Project TVOC concentrations ranged from 523 $\mu g/m^3$ in December 2015 to 1,216 $\mu g/m^3$ in June 2015. The Non-project TVOC concentrations ranged from 90 $\mu g/m^3$ in March 2015 to 379 $\mu g/m^3$ in September 2015.

The TVOC concentration in effluent vapor has generally declined since system startup. Figure 4 provides an overview of the concentration trend over the report period. The containment system has removed a total of 297 pounds of TVOCs, with 235 pounds of Project TVOCs (79.2%) and 62 pounds of Non-project TVOCs (20.8%) as shown on Figure 5. Figure 6 also provides a mass removal rate, which has also declined since system startup.

Benzene, carbon tetrachloride and vinyl chloride, environmentally "A"-rated compounds (as defined in DAR-1 AGC/SGC tables, revised February 28, 2014), were detected in the effluent vapor sample during the annual reporting period; the concentrations were consistent with historical data. Historically, these are the only three environmentally "A"-rated compounds detected in the effluent vapor samples.

Eight tentatively identified compounds (TICs) were also identified by the laboratory (Table 4) during the fourth quarter reporting period. The concentrations of the TICs were consistent with data collected throughout the annual reporting period. The two most commonly identified TICs over the annual reporting period were alkane and pentane.

5.2.2.3 Condensate Sample

Collection of a compliance monitoring condensate sample was not required during the annual reporting period.

5.2.3 Air Emissions Model

Effluent vapor laboratory results were compared to the NYSDEC DAR-1 SGCs (Table 4). In addition, effluent vapor laboratory analytical results were compared to a site-specific modeled annual maximum allowable stack concentration (MASC). The annual MASC was calculated during each monitoring event for individual compounds using the output from a U.S. Environmental Protection Agency (USEPA) SCREEN3 model in conjunction with the NYSDEC DAR-1 AGCs. A scaling factor was calculated using the SCREEN3 model with site-specific physical layout (e.g., building dimension, stack height, terrain) and operating data (e.g., discharge flow rate, temperature) inputs for each monitoring event. The scaling factor was then used to adjust (scale) the NYSDEC DAR-1 AGC to a site-specific annual MASC. A summary of the instantaneous percent (i.e., not time-weighted) of the site-specific annual MASC for detected compounds is provided in Table 6. A summary of the cumulative annual percent (i.e., time-weighted) of the site-specific MASC for detected compounds is also provided in Table 6. A summary of the model input, outputs, and backup calculations is provided in Table 5.

The BPSGCS effluent vapor met applicable air discharge criteria in the fourth quarter reporting period and throughout the annual reporting period, based on the following:

- The measured concentrations of individual VOCs in the effluent did not exceed applicable SGCs (Table 3).
- The measured concentrations of individual VOCs in the effluent did not exceed applicable instantaneous MASCs, as calculated using the USEPA SCREEN 3 Model (Table 6). Similarly, the time-weighted rolling average for all detected compounds is well below the MASCs.

6 CONCLUSIONS AND RECOMMENDATIONS

6.1 Conclusions

The following conclusions are provided regarding the performance and ability of the OU3 BPSGS to comply with the remedial action and compliance objectives for the Site:

- OM&M requirements of the OU3 BPSGCS OM&M Manual were met at the Site during the annual reporting period.
- The BPSGCS generally operated as designed during the annual reporting period to mitigate the off-site migration of soil gas.
    - The BPSGCS operated continuously with the exception of brief shutdown periods for routine and non-routine maintenance (approximately 98% uptime).
    - A total of 23 pounds of VOCs was removed from the subsurface during the annual reporting period, and a total of 297 pounds of VOCs was removed since system startup in 2008.
    - A vacuum of -0.1 iwc or greater was maintained at all induced vacuum monitoring points , based on the annual rolling average, throughout the annual reporting period. While data recorded at several wells indicated that vacuum induced at the well heads was slightly less than the targeted -0.1 iwc, during September and December, the issues causing the reduced vacuums (most notably a build-up of condensation water in the vacuum distribution piping) have been corrected and Northrop Grumman will continue to proactively manage this issue through condensate removal.
    - The operation of the BPSGCS complied with applicable NYSDEC SCGs during the annual reporting period.
    - Effluent vapor emissions met applicable AGC and SGC air discharge criteria during the annual reporting period.

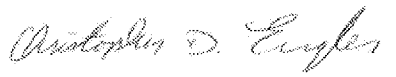
6.2 Recommendations

Based on the information provided herein, Arcadis recommends to continue operation of the BPSGCS. No modifications or upgrades are needed at this time.

7 CERTIFICATION

Statement of Certification

On behalf of Northrop Grumman Systems Corporation, I hereby certify and attest that the Operable Unit 3 Bethpage Park Soil Gas Containment System is operated in compliance with the remedial action objectives provided within the NYSDEC approved Soil Gas Interim Remedial Measure Work Plan dated February 16, 2007, which was prepared pursuant to NYSDEC Administrative Order on Consent Index # W1-0018-04-01 referencing the Former Grumman Settling Ponds Site and dated July 4, 2005.



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Engineer of Record
License # 069748

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TABLES

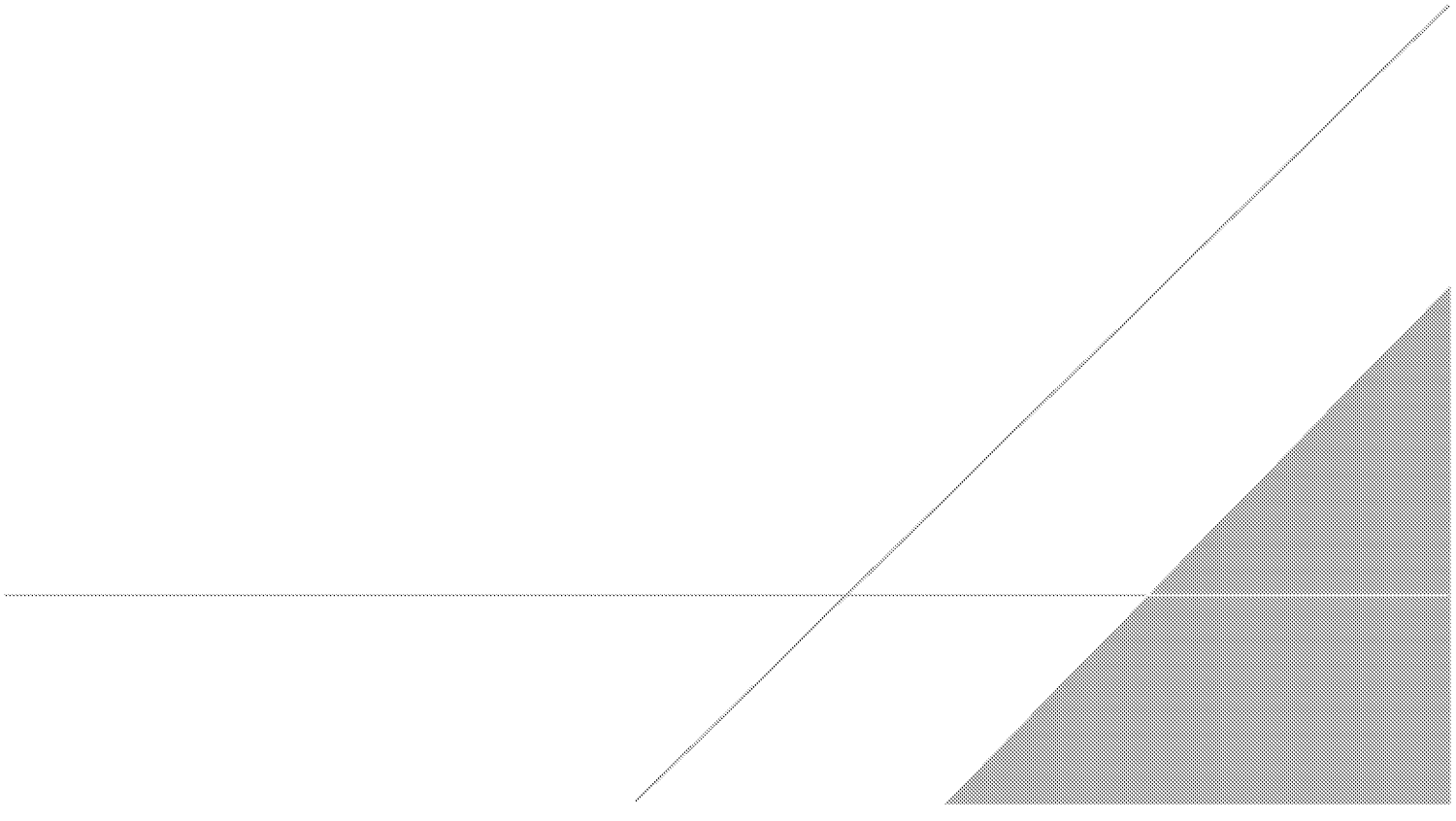

Table 1
Annual Summary of General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

	DW-7S Parameters			DW-7D Parameters			DW-3S Parameters			DW-3D Parameters			DW-5S Parameters			DW-5D Parameters			DW-6S Parameters			DW-6D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
03/12/15	88	-18	-2.0	4.5	-7.0	-0.44	6.0	-8.6	-0.33	10	-7.0	-0.44	83	-17	-1.7	14	-12	-2.6	74	-16	-1.9	7.2	-6.2	-1.7
06/11/15	120	-23	-2.0	4.0	-16	-0.38	5.0	-6.2	-0.22	10	-8.0	-0.32	90	-17	-1.4	13	-12	-2.3	70	-17	-1.4	6.8	-6.0	-1.4
09/04/15	105	-21	-1.8	4.0	-10	-0.40	5.5	-6.0	-0.23	13	-7.5	-0.34	95	-17	-1.6	13	-11	-2.2	82	-17	-1.6	6.4	-5.6	-1.3
12/16/15	105	-26	-1.3	8.0	-13	-0.54	8.0	-7.5	-0.27	4.0	-16	-0.23	108	-21	-1.9	14	-12	-2.5	69	-17	-1.6	2.6	-4.5	-0.63

Notes and abbreviations on last page.

Table 1
Annual Summary of General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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	DW-1S Parameters			DW-1D Parameters			DW-4S Parameters			DW-4D Parameters			DW-8S Parameters			DW-9S Parameters			DW-2S Parameters			DW-2D Parameters		
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum
Date	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc	scfm	iwc	iwc
03/12/15	80	-22	-2.1	2.9	-3.0	-1.2	68	-15	-1.2	4.0	-5.8	-0.55	60	-20	-2.3	48	-16	-1.9	32	-28	-1.7	22	-15	-1.3
06/11/15	85	-21	-1.7	6.2	-3.8	-1.7	68	-15	-1.2	6.0	-6.2	-0.57	60	-18	-1.6	35	-14	-1.4	30	-23	-1.5	33	-22	-2.1
09/04/15	85	-22	-1.7	2.6	-2.3	-1.8	70	-15	-1.3	3.5	-5.0	-0.47	60	-18	-1.7	32	-13	-1.2	28	-24	-1.6	34	-23	-2.2
12/16/15	111	-25	-2.4	2.4	-2.5	-0.79	75	-16	-1.5	5.0	-7.5	-0.64	57	-20	-1.8	37	-15	-1.5	22	-21	-1.4	34	-23	-2.2

Notes and abbreviations on last page.

Table 1
Annual Summary of General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

	DW-10S Parameters			DW-11S Parameters			Knock Out Tank Parameters - Vacuum			Condensate Water Collected(1)	Blower Parameters BL-200			Blower Parameters BL-300			Blower Parameters BL-400			Combined Effluent Parameters				
	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Flow Rate at Manifold	Vacuum at Manifold	Wellhead Vacuum	Influent KO-200	Influent KO-300	Influent KO-400	Influent ST-510	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Influent Vacuum	Effluent Pressure	Blower Speed	Total Effluent Flow Rate(2)	Total Effluent PID	Heat Exchanger Influent Temp.	Total Effluent Pressure	Heat Exchanger Effluent Temp.
Date	scfm	iwc	iwc	scfm	iwc	iwc	iwc	iwc	iwc	Gallons	iwc	iwc	Hz	iwc	iwc	Hz	iwc	iwc	Hz	scfm	ppmv	°F	iwc	°F
03/12/15	37	-17	-2.3	34	-27	-2.5	--	--	-38	100	--	--	--	--	--	--	-38	1.0	60.00	639	0.0	100	2.0	75
06/11/15	30	-14	-1.5	33	-24	-2.2	--	--	-40	115	--	--	--	--	--	--	-44	1.0	60.00	597	0.2	115	2.0	120
09/04/15	32	-16	-1.7	33	-24	-2.3	--	--	-38	105	--	--	--	--	--	--	-37	1.0	60.00	576	0.0	107	2.0	104
12/16/15	35	-16	-1.8	26	-23	-2.3	--	--	-38	0	--	--	--	--	--	--	-41	1.5	60.00	662	0.0	105	2.5	87

Notes and abbreviations on last page.

Table 1
Annual Summary of General System Operating Parameters
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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Notes and Abbreviations:

°F	degrees Fahrenheit
DW	depressurization well
gal	gallons
Hz	Hertz
iwc	inches of water column
--	not applicable
PID	photoionization detector
ppmv	parts per million by volume
scfm	standard cubic feet per minute

1. Total gallons of water accumulated at storage tank ST-510 per quarter.
2. Total effluent air velocity in feet per minute was measured using a hand-held anemometer at the stack effluent location. The total effluent flow rate in scfm was calculated by multiplying the measured air velocity by the pipe area, the ratio of the standard air temperature to the measured air temperature, and the ratio of the measured air pressure to the standard air pressure.
3. Value was remeasured on March 13, 2015 due to an erroneous value recorded on March 12, 2015.

Table 2
Annual Summary of Induced Vacuum Readings at Compliance Monitoring Points
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York. [1][2]

Well ID:	DW-7S		DW-7D	DW-3S	DW-3D	DW-5S		DW-5D	DW-1S			DW-1D	DW-4D	DW-8S		DW-2S		DW-2D		DW-11S	
MP ID:	VMWC-14A	VMWC-14B	VMWC-14D	VMWC-11B	VMWC-12D	VMWC-15A	VMWC-15B	VMWC-15D	VMWC-3A	VMWC-3B	VMWC-3C	VMWC-3D	VMWC-16D	VMWC-16A	VMWC-16B	VMWC-7A	VMWC-7B	VMWC-13D	VMWC-17D	VMWC-18A	VMWC-18B
Date	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc	iwc
03/12/15	-0.14	-0.19	-0.20	-0.17	-0.20	-0.30	-0.17	-0.20	-0.17	-0.18	-0.18	-0.18	-0.25	-0.20	-0.22	-0.20	-0.20	-0.11	-0.26	-0.20	-0.20
06/11/15	-0.11	-0.20	-0.20	-0.13	-0.20	-0.12	-0.11	-0.13	-0.20	-0.13	-0.12	-0.19	-0.17	-0.13	-0.15	-0.11	-0.10	-0.15	-0.23	-0.10	-0.13
09/04/15	-0.11	-0.18	-0.19	-0.12	-0.13	-0.15	-0.15	-0.15	-0.13	-0.14	-0.13	-0.18	-0.18	-0.13	-0.14	-0.11	-0.10	-0.25	-0.30	-0.099	-0.11
12/16/15	-0.14	-0.23	-0.19	-0.16	-0.13	-0.18	-0.17	-0.16	-0.17	-0.17	-0.18	-0.19	-0.20	-0.16	-0.17	-0.098	-0.096	-0.13	-0.25	-0.095	-0.11
Time Weighted Rolling Average[3]	**-0.13**	**-0.20**	**-0.19**	**-0.15**	**-0.16**	**-0.19**	**-0.15**	**-0.16**	**-0.17**	**-0.16**	**-0.15**	**-0.19**	**-0.20**	**-0.16**	**-0.17**	**-0.13**	**-0.12**	**-0.16**	**-0.26**	**-0.12**	**-0.14**

Gross Average Compliance Points [4]	
12/16/15	-0.16

Notes and Abbreviations:

DW	depressurization well
VMWC	vapor monitoring well cluster
iwc	inches of water column

1 All induced vacuum measurements units in iwc. Values shown have been rounded to two significant figures.

2 Compliance goal is -0.1 iwc of vacuum at all compliance monitoring points, based on a twelve-month rolling average.

3 Time weighted rolling average calculated by summing the products of the instantaneous induced vacuum readings and the number of days between readings for a 12-month monitoring period, and dividing by the total time period between the first and last quarterly induced vacuum readings.

4 Gross average compliance points calculated by summing the induced vacuum values for the noted monitoring event and dividing by the number of readings.

Table 3
Total Effluent Vapor Sample Analytical Results
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.[1]

ARCADIS Design & Consultancy for natural and built assets

Compound (units in µg/m³)		Sample ID: Sample Date:	VSP-601 3/12/2015	VSP-601 6/11/2015	VSP-601 9/4/2015	VSP-601 12/16/2015
Project VOCs	CAS No.	SCG				
1,1,1-Trichloroethane	71-55-6	9,000	**10**	**9.8**	**13**	**8.7**
1,1-Dichloroethane	75-34-3	NS	**8.9**	**9.7**	**11**	**8.5**
1,1-Dichloroethene	75-35-4	380[3]	**1.3**	<3.2 U	**1.0**	**0.83**
1,2-Dichloroethane	107-06-2	NS	< 0.81 U	<3.2 U	<0.81 U	<0.81 U
Benzene	71-43-2	1,300	**0.31 J**	<2.6 U	**23**	**0.38 J**
cis-1,2-Dichloroethene	156-59-2	190,000[4]	**290 D**	**646 D**	**424 D**	**251 D**
Tetrachloroethene	127-18-4	300	**11**	**26**	**24**	**12**
Toluene	108-88-3	37,000	**1.2**	**1.7 J**	**24**	**4.5**
trans-1,2-Dichloroethene	156-60-5	190,000[4]	**2.0**	**3.4**	**4.8**	**2.4**
Trichloroethylene	79-01-6	14,000	**300 D**	**514**	**513 D**	**233 D**
Vinyl chloride	75-01-4	180,000	**1.4**	**3.6**	**0.84**	**0.77**
Xylene-O	95-47-6	22,000	< 0.87 U	<3.5 U	**11**	<0.87 U
Xylenes - M,P	1330-20-7	22,000	< 0.87 U	**1.7 J**	**51.3**	**0.83 J**
Subtotal Project VOCs			**624**	**1,216**	**1,101**	**523**
Non-Project VOCs						
1,1,2,2-Tetrachloroethane	79-34-5	NS	< 1.4 U	<5.5 U	<1.4 U	<1.4 U
1,1,2-Trichloroethane	79-00-5	NS	< 1.1 U	<4.4 U	<1.1 U	<1.1 U
1,2-Dichloropropane	78-87-5	NS	< 0.92 U	<3.7 U	<0.92 U	<0.92 U
1,3-Butadiene	106-99-0	NS	< 0.44 U	<1.8 U	<0.44 U	<0.44 U
2-Butanone	78-93-3	13,000	< 0.59 U	<2.4 U	**1.1**	<0.59 U
2-Hexanone	591-78-6	4,000	< 0.82 U	<3.3 U	**1.8**	<0.82 U
4-Methyl-2-Pentanone	108-10-1	31,000	< 0.82 U	<3.3 U	<0.82 U	<0.82 U
1-Chloro-1,1-difluoroethane (Freon 142b)	75-68-3	NS	**66.6**	**298**	**337 D**	**87.5**
Acetone	67-64-1	180,000	**3.6**	**2.3**	**3.3**	<0.48 U
Bromodichloromethane	75-27-4	NS	< 1.3 U	<5.4 U	<1.3 U	<1.3 U
Bromoform	75-25-2	NS	< 2.1 U	<8.3 U	<2.1 U	<2.1 U
Bromomethane	74-83-9	3,900	< 0.78 U	<3.1 U	<0.78 U	<0.78 U
Carbon Disulfide	75-15-0	6,200	< 0.62 U	<2.5 U	<0.62 U	<0.62 U
Carbon Tetrachloride	56-23-5	1,900	< 1.3 U	<5.0 U	**1.1 J**	<1.3 U
Chlorobenzene	108-90-7	NS	< 0.92 U	<3.7 U	<0.92 U	<0.92 U
Chlorodibromomethane	124-48-1	NS	< 1.7 U	<6.8 U	<1.7 U	<1.7 U

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.[1]

Compound (units in µg/m³)	CAS No	SGC	Sample ID: VSP-601 Sample Date: 3/12/2015	VSP-601 6/11/2015	VSP-601 9/4/2015	VSP-601 12/16/2015
Non-Project VOCs (cont.)						
Chloroethane	75-00-3	NS	< 0.53 U	<2.1 U	<0.53 U	<0.53 U
Chlorodifluoromethane (Freon 22)	75-45-6	NS	**3.3**	<2.8 U	**2.0**	<0.70 U
Chloroform	67-66-3	150	**7.3**	**11**	**21**	**15**
Chloromethane	74-87-3	22,000	< 0.41 U	<1.7 U	<0.41 U	<0.41 U
cis-1,3-Dichloropropene	10061-01-5	NS	< 0.91 U	<3.6 U	<0.91 U	<0.91 U
Dichlorodifluoromethane (Freon 12)	75-71-8	NS	**2.5**	**2.3 J**	**4.1**	**2.2**
Ethylbenzene	100-41-4	NS	< 0.87 U	<3.5 U	**4.8**	<0.87 U
Trichlorotrifluoroethane (Freon 113)	76-13-1	960,000	< 1.5 U	<6.1 U	<1.5 U	<1.5 U
Methyl Tert-Butyl Ether	1634-04-4	NS	< 0.72 U	<2.9 U	<0.72 U	<0.72 U
Methylene Chloride	75-09-2	14,000	**5.2**	<2.8 U	**0.80**	**1.3**
Styrene	100-42-5	17,000	< 0.85 U	<3.4 U	<0.85 U	<0.85 U
Trans-1,3-Dichloropropene	10061-02-6	NS	< 0.91 U	<3.6 U	<0.91 U	<0.91 U
Trichlorofluoromethane (Freon 11)	75-69-4	9,000	**1.6**	<4.5 U	**1.9**	**1.2**
Subtotal Non-Project VOCs			**90**	**314**	**379**	**107**
TVOC[2]			**714**	**1,530**	**1,480**	**630**

Notes and abbreviations on last page.

Table 3
Total Effluent Vapor Sample Analytical Results
Fourth Quarter 2015
Northrop Grumman Operable Unit 3
Bethpage Park Soil Gas Containment System

ARCADIS Design & Consultancy for natural and built assets

Notes and Abbreviations:

Bold	Bold data indicates that the analyte was detected at or above its reporting limit.
ELAP	Environmental Laboratory Approval Program.
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014. An interim SGC was not developed for these compounds because they have low toxicity ratings, as specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
CAS No.	Chemical Abstracts Service list number.
DAR-1	Division of Air Resources-1 Air Guide-1.
NYSDEC	New York State Department of Environmental Conservation.
NYSDOH	New York State Department of Health.
AGC	Allowable Annual Guideline Concentration.
D	Based on diluted sample analysis
J	Estimated.
--	Not analyzed.
U	Compound was analyzed for but not detected
USEPA	U.S. Environmental Protection Agency.
VOC	volatile organic compound
$\mu g/m^3$	micrograms per cubic meter
<	Compound not detected above its laboratory quantification limit.

1. Vapor samples collected by ARCADIS on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.
2. TVOC determined by summing individual detections and rounding to the nearest whole number.
3. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for 1,1- dichloroethene, which is not defined as a high-toxicity compound, the Interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2. or 1,600 $\mu g/m^3$ / 4.2 = approximately 380 $\mu g/m^3$. An interim SGC was developed for this compound because it has a moderate toxicity rating, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.
4. An SGC was not provided in the DAR-1 AGC/SGC Tables, revised February 28, 2014. An interim SGC was developed based on guidance provided in Section IV.A.2.b.1 of the New York State DAR-1 Guidelines for the Control of Toxic Ambient Air Contaminants, 1991 edition. Specifically for cis-1,2 dichloroethene and trans-1,2 dichloroethene, which are not defined as a high-toxicity compounds, the interim SGC = (smaller of Time Weighted Average [TWA] - Threshold Limit Value or TWA - Recommended Exposure Limit)/4.2 or 790,000 $\mu g/m^3$ / 4.2 = approximately 190,000 $\mu g/m^3$. An interim SGC was developed for these compounds because they have moderate toxicity ratings, as specified in the DAR-1 AGC/SGC Tables, revised February 28, 2014.

Table 4
Total Effluent Vapor Sample Analytical Results
Fourth Quarter 2015, Tentatively Identified Compounds
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.[1,2,3]

ARCADIS Design & Consultancy for natural and built assets

Sample ID:	VSP-601	VSP-601	VSP-601	VSP-601					
Sample Date:	3/12/2015	6/11/2015	9/4/2015	12/16/2015					
Units:	ppbv	ppbv	ppbv	ppbv					
1,2,4-Trimethylbenzene	--	--	**2.9 JN**	--					
2,3-Dimethylpentane	--	--	--	**1.4 JN**					
2-Methylbutane	--	--	--	**2.3 JN**					
2-Methylpentane	--	--	--	**3.8 JN**					
3-Methylhexane	--	--	--	**1.4 JN**					
3-Methylpentane	--	--	--	**2.2 JN**					
Alkane	**2.7 JN**	--	**3.8 JN**	**2.5 JN**					
C3 Alkyl Benzene	--	--	**1.4 JN**	--					
Methylcyclopentane	--	--	--	**3.8 JN**					
Pentane	--	--	**1.8 JN**	**1.5 JN**					
Unknown Alkene	--	--	**2.4 JN**	--					
Unknown Alkene	--	--	**1.3 JN**	--					
Unknown Alkene	--	--	**1.3 JN**	--					

Notes and Abbreviations:

-- Not analyzed.
ELAP Environmental Laboratory Approval Program.
JN Compound tentatively identified, concentration is estimated.
NYSDO New York State Department of Health.
ppbv parts per billion by volume
USEPA U.S. Environmental Protection Agency.
VOC volatile organic compound

1. Vapor samples collected by ARCADIS on the dates shown and submitted to a NYSDOH ELAP certified laboratory for VOC analyses per Modified USEPA Method TO-15.
2. Tentatively identified compounds are identified based on review of mass spectrometry results via a comprehensive library search of all organic compound
3. All results are estimated.

Table 5
Summary of SCREEN3 Model Input and Outputs
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

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Parameters	Date Sampled:	03/12/15	06/11/15	09/04/15	12/16/15
SCREEN3 Model Input					
Source Type		Point	Point	Point	Point
Emission Rate (g/s)		1	1	1	1
Stack Height (m)		10.1	10.1	10.1	10.1
Stack Inside Diameter (m)		0.41	0.41	0.41	0.41
Air Flow Rate (scfm)[1]		639 [9]	597	576	662
Air Flow Rate (acfm @ stack temp)[2]		645	653	613	683
Stack Gas Exit Temperature (K)[1]		297	322	313	304
Ambient Air Temperature (K)[3]		277	297	297	281
Receptor Height (m)[4]		1.5	1.5	1.5	1.5
Urban/Rural		Urban	Urban	Urban	Urban
Building Height (m)		2.4	2.4	2.4	2.4
Min Horizontal Bldg Dim (m)		4.9	4.9	4.9	4.9
Max Horizontal Bldg Dim (m)		5.0	5.0	5.0	5.0
Consider Bldg Downwash?		Yes	Yes	Yes	Yes
Simple/Complex Terrain Above Stack		Simple	Simple	Simple	Simple
Simple/Complex Terrain Above Stack Base		Simple	Simple	Simple	Simple
Meteorology		Full	Full	Full	Full
Automated Distances Array		Yes	Yes	Yes	Yes
Terrain Height Above Stack Base		0	0	0	0
SCREEN3 Model Output					
1-HR Max Concentration at Receptor Height ($\mu g/m^3$)[5]		1301	1257	1330	1248
Annualization Factor[6]		0.08	0.08	0.08	0.08
Average Annual Concentration at Receptor Height ($\mu g/m^3$)[7]		104.1	100.6	106.4	99.8
Distance To Max Concentration (m)[8]		45	45	44	46

Notes and abbreviations on last page.

Table 5
Summary of SCREEN3 Model Input and Outputs
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System
Former Grumman Settling Ponds, Bethpage, New York.

Notes and Abbreviations:

acfm	actual cubic feet per minute
ft	feet
g/s	grams per second
°K	degrees Kelvin
m	meter
scfm	standard cubic feet per minute
$\mu g/m^3$	micrograms per cubic meter
USEPA	U.S. Environmental Protection Agency

1. The stack air flow rate (in scfm) and exit temperature were measured using a handheld thermo-anemometer. Values were measured at the stack effluent location.
2. The stack air flow rate at the stack temperature (in acfm) was calculated by dividing the stack air flow rate in scfm by the ratio of the standard temperature to the actual stack gas exit temperature.
3. The ambient temperature was recorded from the weather.newday.com website for Islip, New York. The mean actual temperature from the website was used in model calculation.
4. The receptor height corresponds to the average inhalation level.
5. SCREEN3 calculated constituent concentration at listed conditions at the specified inhalation level.
6. A USEPA time averaging conversion factor of 0.08 was used to convert the 1-hour maximum concentration output to an annual average.
7. Average annual constituent concentration at the receptor height was calculated by multiplying the one hour maximum concentration by the annualization factor.
8. SCREEN3 calculated distance to the 1-hour maximum concentration.
9. Value remeasured on March 13, 2015 due to an erroneous value recorded on March 12, 2015.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

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Compound		Actual Effluent Concentrations[1] (µg/m³)				
		3/12/2015	6/11/2015	9/4/2015	12/16/2015	
1,1,1-Trichloroethane		10	9.8	13	8.7	
1,1-Dichloroethane		8.9	9.7	11	8.5	
1,1-Dichloroethene		1.3	0	1.0	0.83	
1-Chloro-1,1-difluoroethane (Freon 142b)		66.6	298	337	87.5	
2-Butanone		0	0	1.1	0	
2-Hexanone		0	0	1.8	0	
Acetone		3.6	2.3	3.3	0	
Benzene		0.31	0	23	0.38	
Carbon tetrachloride		0	0	1.1	0	
Chlorodifluoromethane (Freon 22)		3.3	0	2	0	
Chloroform		7.3	11	21	15	
cis-1,2-Dichloroethene		292	646	424	251	
Dichlorodifluoromethane (Freon 12)		2.5	2.3	4.1	2.2	
Ethylbenzene		0	0	4.8	0	
Methylene Chloride		5.2	0	0.8	1.3	
Tetrachloroethene		11	26	24	12	
Toluene		1.2	1.7	24	4.5	
trans-1,2-Dichloroethene		2	3.4	4.8	2.4	
Trichloroethylene		296	514	513	233	
Trichlorofluoromethane (Freon 11)		1.6	0	1.9	1.2	
Vinyl chloride		1.4	3.6	0.84	0.77	
Xylene-O		0	0	11	0	
Xylenes - M,P		0	1.7	51.3	0.83	

Notes and abbreviations on last page.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

Compound	AGC[1] ($\mu g/m^3$)	Annual MASC[1] ($\mu g/m3$)				
		3/12/2015	6/11/2015	9/4/2015	12/16/2015	
1,1,1-Trichloroethane	5,000	1.6E+08	1.6E+08	1.6E+08	1.6E+08	
1,1-Dichloroethane	0.63	2.0E+04	2.0E+04	2.0E+04	2.0E+04	
1,1-Dichloroethene	200	6.3E+06	6.5E+06	6.5E+06	6.2E+06	
1-Chloro-1,1-difluoroethane (Freon 142b)	50,000	1.6E+09	1.6E+09	1.6E+09	1.6E+09	
2-Butanone	5,000	1.6E+08	1.6E+08	1.6E+08	1.6E+08	
2-Hexanone	30	9.5E+05	9.7E+05	9.7E+05	9.3E+05	
Acetone	30,000	9.5E+08	9.7E+08	9.7E+08	9.3E+08	
Benzene	0.13	4.1E+03	4.2E+03	4.2E+03	4.0E+03	
Carbon tetrachloride	0.17	5.4E+03	5.5E+03	5.5E+03	5.3E+03	
Chlorodifluoromethane (Freon 22)	50,000	1.6E+09	1.6E+09	1.6E+09	1.6E+09	
Chloroform	14.7	4.6E+05	4.7E+05	4.8E+05	4.6E+05	
cis-1,2-Dichloroethene	63	2.0E+06	2.0E+06	2.0E+06	2.0E+06	
Dichlorodifluoromethane (Freon 12)	12,000	3.8E+08	3.9E+08	3.9E+08	3.7E+08	
Ethylbenzene	1,000	3.2E+07	3.2E+07	3.2E+07	3.1E+07	
Methylene Chloride	60	1.9E+06	1.9E+06	1.9E+06	1.9E+06	
Tetrachloroethene	4.0	1.3E+05	1.3E+05	1.3E+05	1.2E+05	
Toluene	5,000	1.6E+08	1.6E+08	1.6E+08	1.6E+08	
trans-1,2-Dichloroethene	63	2.0E+06	2.0E+06	2.0E+06	2.0E+06	
Trichloroethylene	0.2	6.3E+03	6.5E+03	6.5E+03	6.2E+03	
Trichlorofluoromethane (Freon 11)	5,000	1.6E+08	1.6E+08	1.6E+08	1.6E+08	
Vinyl chloride	0.068	2.1E+03	2.2E+03	2.2E+03	2.1E+03	
Xylene-O	100	3.2E+06	3.2E+06	3.2E+06	3.1E+06	
Xylenes - M,P	100	3.2E+06	3.2E+06	3.2E+06	3.1E+06	

Notes and abbreviations on last page.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

ARCADIS Design & Consultancy for natural and built assets

Compound		Percent of Annual MASC[2]				Cumulative % MASC[3]
		3/12/2015	6/11/2015	9/4/2015	12/16/2015	
1,1,1-Trichloroethane		0.0%	0.0%	0.0%	0.0%	0.0%
1,1-Dichloroethane		0.045%	0.048%	0.054%	0.043%	0.0%
1,1-Dichloroethene		0.0%	0.0%	0.0%	0.0%	0.0%
1-Chloro-1,1-difluoroethane (Freon 142b)		0.0%	0.0%	0.0%	0.0%	0.0%
2-Butanone		0.0%	0.0%	0.0%	0.0%	0.0%
2-Hexanone		0.0%	0.0%	0.0%	0.0%	0.0%
Acetone		0.0%	0.0%	0.0%	0.0%	0.0%
Benzene		0.0076%	0.0%	0.54%	0.01%	0.1%
Carbon tetrachloride		0.0%	0.0%	0.020%	0.0%	0.0%
Chlorodifluoromethane (Freon 22)		0.0%	0.0%	0.0%	0.0%	0.0%
Chloroform		0.0016%	0.0023%	0.0044%	0.0033%	0.0%
cis-1,2-Dichloroethene		0.015%	0.032%	0.021%	0.013%	0.0%
Dichlorodifluoromethane (Freon 12)		0.0%	0.0%	0.0%	0.0%	0.0%
Ethylbenzene		0.0%	0.0%	0.0%	0.0%	0.0%
Methylene Chloride		0.0%	0.0%	0.0%	0.0%	0.0%
Tetrachloroethene		0.0087%	0.020%	0.018%	0.010%	0.0%
Toluene		0.0%	0.0%	0.0%	0.0%	0.0%
trans-1,2-Dichloroethene		0.0001%	0.0002%	0.0002%	0.0001%	0.0%
Trichloroethylene		4.7%	8.0%	7.9%	3.7%	6.0%
Trichlorofluoromethane (Freon 11)		0.0%	0.0%	0.0%	0.0%	0.0%
Vinyl chloride		0.065%	0.16%	0.04%	0.04%	0.1%
Xylene-O		0.0%	0.0%	0.0003%	0.0%	0.0%
Xylenes - M,P		0.0%	0.0%	0.0%	0.0%	0.0%

Notes and abbreviations on last page.

Table 6
Summary of Maximum Allowable Stack Concentration Calculations
Fourth Quarter 2015
Northrop Grumman Operable Unit 3, Bethpage Park Soil Gas Containment System,
Former Grumman Settling Ponds, Bethpage, New York.

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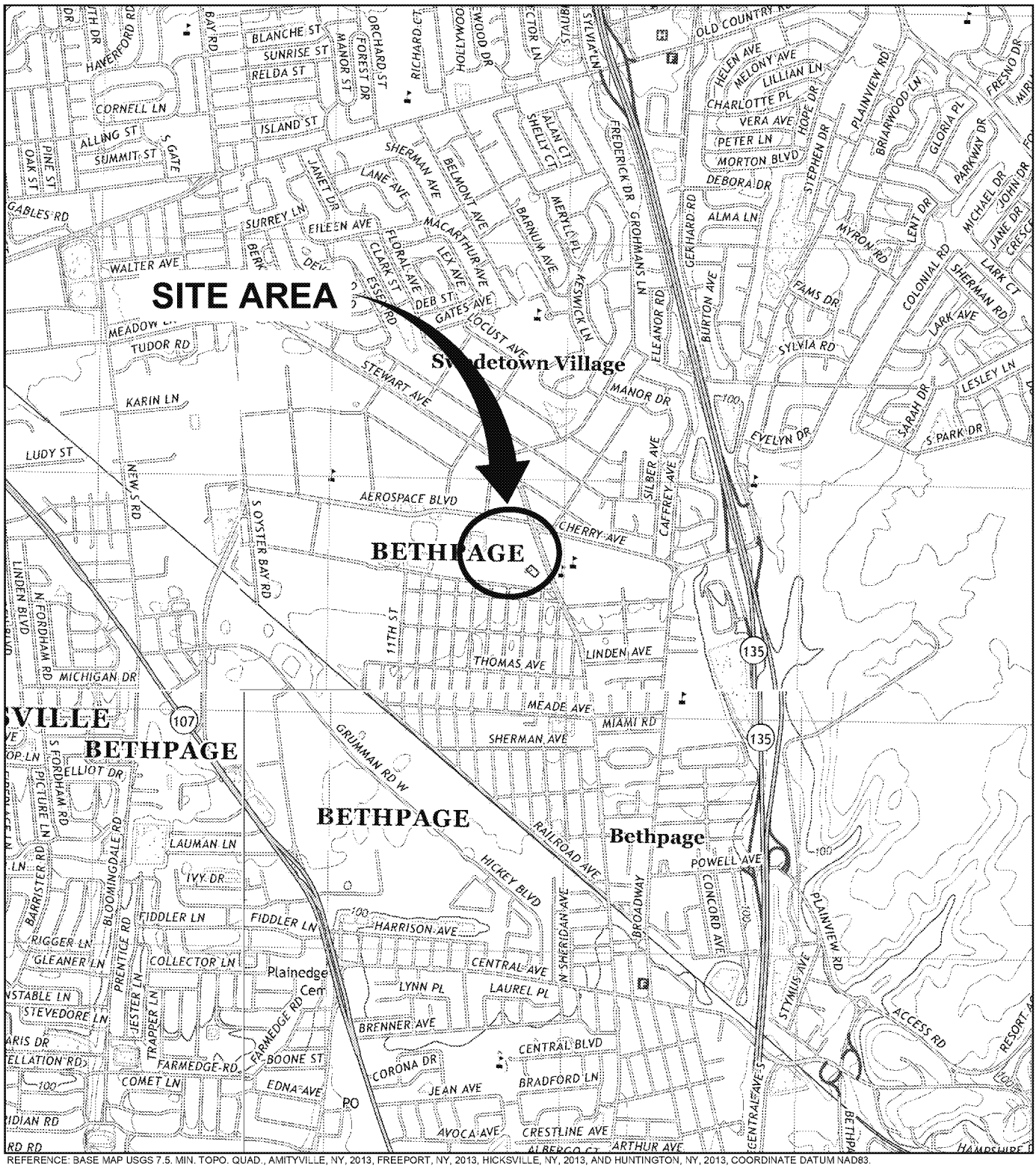
Notes and Abbreviations:

AGC	Allowable Annual Guideline Concentration
DAR-1	Division of Air Resources Air Guide-1
MASC	Maximum Allowable Stack Concentration
$\mu g/m^3$	micrograms per cubic meter
NS	Guideline concentrations not specified in the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
NYSDEC	New York State Department of Environmental Conservation
SGC	Short-term Guideline Concentration
%	percent

1. Actual effluent concentrations are analytical results from air samples collected on the dates shown. Data in this table corresponds to the past year of system operation. Table summarizes detected compounds only.
2. AGC refers to the compound-specific AGC per the NYSDEC DAR-1 AGC/SGC tables, revised February 28, 2014.
3. Annual MASC was calculated by dividing the product of the AGC of a compound and the ratio of the SCREEN3 gas emission rate and the SCREEN 3 average annual concentration at receptor height by the air flow rate at the stack temperature and multiplying by the appropriate conversion factors.
4. Percent of MASC was calculated by dividing the actual effluent concentration by the MASC for the past four quarters of operation.
5. Cumulative percent of the MASC was calculated using a time-weighted average of the percent MASC per event. Values shown have been rounded to

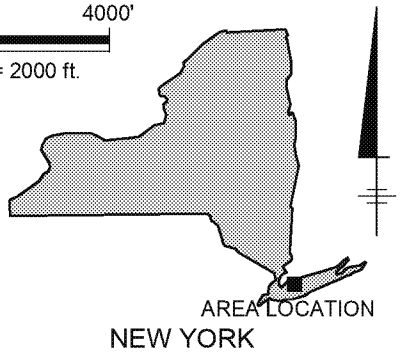
FIGURES



REFERENCE: BASE MAP USGS 7.5. MIN. TOPO. QUAD., AMITYVILLE, NY, 2013, FREEPORT, NY, 2013, HICKSVILLE, NY, 2013, AND HUNTINGTON, NY, 2013, COORDINATE DATUM NAD83.

0 2000' 4000'

Approximate Scale: 1 in. = 2000 ft.



NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)

SITE LOCATION MAP

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FIGURE
1

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
Z:\ENVCAD\SYRACUSE\ACT\NY0014986\Sitel.loc\Map.dwg LAYOUT: BP SAVED: 2/15/2016 1:16 AM ACADVER: 19.1S (LMS TECH) PAGESETUP: ---- PLOTSTYLETABLE: PLTFULL.CTB PLOTTED: 2/25/2016 2:21 PM BY: SANCHEZ, ADRIAN
XREFS: IMAGES: PROJECTNAME: ----
2013Amityville.jpg
2013Freeport.jpg
2013Hicksville.jpg
2013Huntington.jpg

PROPERTY OWNED BY TOWN OF OYSTER BAY

STACK LOCATION
grass
GRASS
TREATMENT BUILDING AREA
McKAY FIELD
McKAY FIELD ACCESS ROAD
FORMER TRANSFORMER AREA
ARUMDAUN PRESBYTERIAN CHURCH VISION CENTER (FORMER GRUMMAN PLANT 24)
PARKING LOT
PLANT 24 ACCESS ROAD
FORMER GRUMMAN PLANT 24 ACCESS ROAD PROPERTY
grass
bit.

VMWC-14A
VMWC-14B
VMWC-14D
DW-7S
DW-7D
DW-3S
DW-3D
VMWC-9A
VMWC-9B
VMWC-10B
VMWC-10D
VMWC-11B
VMWC-11D
VMWC-12D
VMWC-15A
VMWC-15B
VMWC-15D
DW-5D
DW-5S
DW-6S
DW-6D
VMWC-3A/B/C/D
VMWC-2A/C/D
VMWC-1B/D
VMWC-1A/C
VMWC-4A/B/C/D
DW-1D
DW-1S
VMWC-16B
VMWC-16A
DW-4S
DW-4D
DW-8S
VMWC-16D
VMWC-17D
DW-9S
VMWC-5A/B/D
VMWC-6A/B/D
DW-2S
DW-2D
VMWC-7A/B
VMWC-7D
VMWC-18B
VMWC-18A
DW-10S
VMWC-13D
DW-11S

EIGHTH ST.
SEVENTH ST.
SIXTH ST.
FIFTH ST.
TH ST.

VMWC-14A	
Date	IV (IWC)
12/16/2015	−0.14
9/4/2015	−0.11
6/11/2015	−0.11
3/12/2015	−0.14

VMWC-14B	
Date	IV (IWC)
12/16/2015	−0.23
9/4/2015	−0.18
6/11/2015	−0.20
3/12/2015	−0.19

VMWC-14D	
Date	IV (IWC)
12/16/2015	−0.19
9/4/2015	−0.19
6/11/2015	−0.20
3/12/2015	−0.20

VMWC-11B	
Date	IV (IWC)
12/16/2015	−0.16
9/4/2015	−0.12
6/11/2015	−0.13
3/12/2015	−0.17

VMWC-12D	
Date	IV (IWC)
12/16/2015	−0.13
9/4/2015	−0.13
6/11/2015	−0.20
3/12/2015	−0.20

VMWC-3A	
Date	IV (IWC)
12/16/2015	−0.17
9/4/2015	−0.13
6/11/2015	−0.20
3/12/2015	−0.17

VMWC-3B	
Date	IV (IWC)
12/16/2015	−0.17
9/4/2015	−0.14
6/11/2015	−0.13
3/12/2015	−0.18

VMWC-3C	
Date	IV (IWC)
12/16/2015	−0.18
9/4/2015	−0.13
6/11/2015	−0.12
3/12/2015	−0.18

VMWC-3D	
Date	IV (IWC)
12/16/2015	−0.19
9/4/2015	−0.18
6/11/2015	−0.19
3/12/2015	−0.18

VMWC-16D	
Date	IV (IWC)
12/16/2015	−0.20
9/4/2015	−0.18
6/11/2015	−0.17
3/12/2015	−0.25

VMWC-16B	
Date	IV (IWC)
12/16/2015	−0.17
9/4/2015	−0.14
6/11/2015	−0.15
3/12/2015	−0.22

VMWC-16A	
Date	IV (IWC)
12/16/2015	−0.16
9/4/2015	−0.13
6/11/2015	−0.13
3/12/2015	−0.20

VMWC-17D	
Date	IV (IWC)
12/16/2015	−0.25
9/4/2015	−0.30
6/11/2015	−0.23
3/12/2015	−0.26

VMWC-7A	
Date	IV (IWC)
12/16/2015	−0.098
9/4/2015	−0.11
6/11/2015	−0.11
3/12/2015	−0.20

VMWC-7B	
Date	IV (IWC)
12/16/2015	−0.096
9/4/2015	−0.10
6/11/2015	−0.10
3/12/2015	−0.20

VMWC-13D	
Date	IV (IWC)
12/16/2015	−0.13
9/4/2015	−0.25
6/11/2015	−0.15
3/12/2015	−0.11

VMWC-18B	
Date	IV (IWC)
12/16/2015	−0.11
9/4/2015	−0.11
6/11/2015	−0.13
3/12/2015	−0.20

VMWC-18A	
Date	IV (IWC)
12/16/2015	−0.095
9/4/2015	−0.099
6/11/2015	−0.10
3/12/2015	−0.20

VMWC-15D	
Date	IV (IWC)
12/16/2015	−0.16
9/4/2015	−0.15
6/11/2015	−0.13
3/12/2015	−0.20

VMWC-15B	
Date	IV (IWC)
12/16/2015	−0.17
9/4/2015	−0.15
6/11/2015	−0.11
3/12/2015	−0.17

VMWC-15A	
Date	IV (IWC)
12/16/2015	−0.18
9/4/2015	−0.15
6/11/2015	−0.12
3/12/2015	−0.30

LEGEND:

- PROPERTY LINE NORTHROP GRUMMAN
- 6' CHAIN LINK FENCE
- VAPOR RECOVERY LINES
- VMWC-9A — NON-COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- VMWC-14A — COMPLIANCE-RELATED VACUUM MONITORING WELL CLUSTER
- DW-3S — SHALLOW DEPRESSURIZATION WELL
- DW-3D — DEEP DEPRESSURIZATION WELL
- IV — INDUCED VACUUM MEASUREMENT
- (IWC) — INCHES OF WATER COLUMN
- USEPA — UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

0 50' 100'
SCALE IN FEET

NOTES:

1. USEPA'S RADON GUIDANCE RECOMMENDS NEGATIVE PRESSURE OF 0.035 INCHES OF WATER FOR THE CONTROL OF SOIL VAPOR (EPA 625/R-93-011, 1993).
2. SYSTEM DESIGN OBJECTIVE IS TO MAINTAIN -0.1 IWC OF INDUCED VACUUM AT ALL COMPLIANCE-RELATED VACUUM MONITORING WELLS ON A 12-MONTH ROLLING AVERAGE (ARCADIS 2007).
3. DATA SHOWN HEREIN ARE COLLECTED FROM COMPLIANCE-RELATED VACUUM MONITORING WELLS ONLY.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

GENERAL SITE PLAN AND MONITORING WELL VACUUM MEASUREMENTS BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM, 2015

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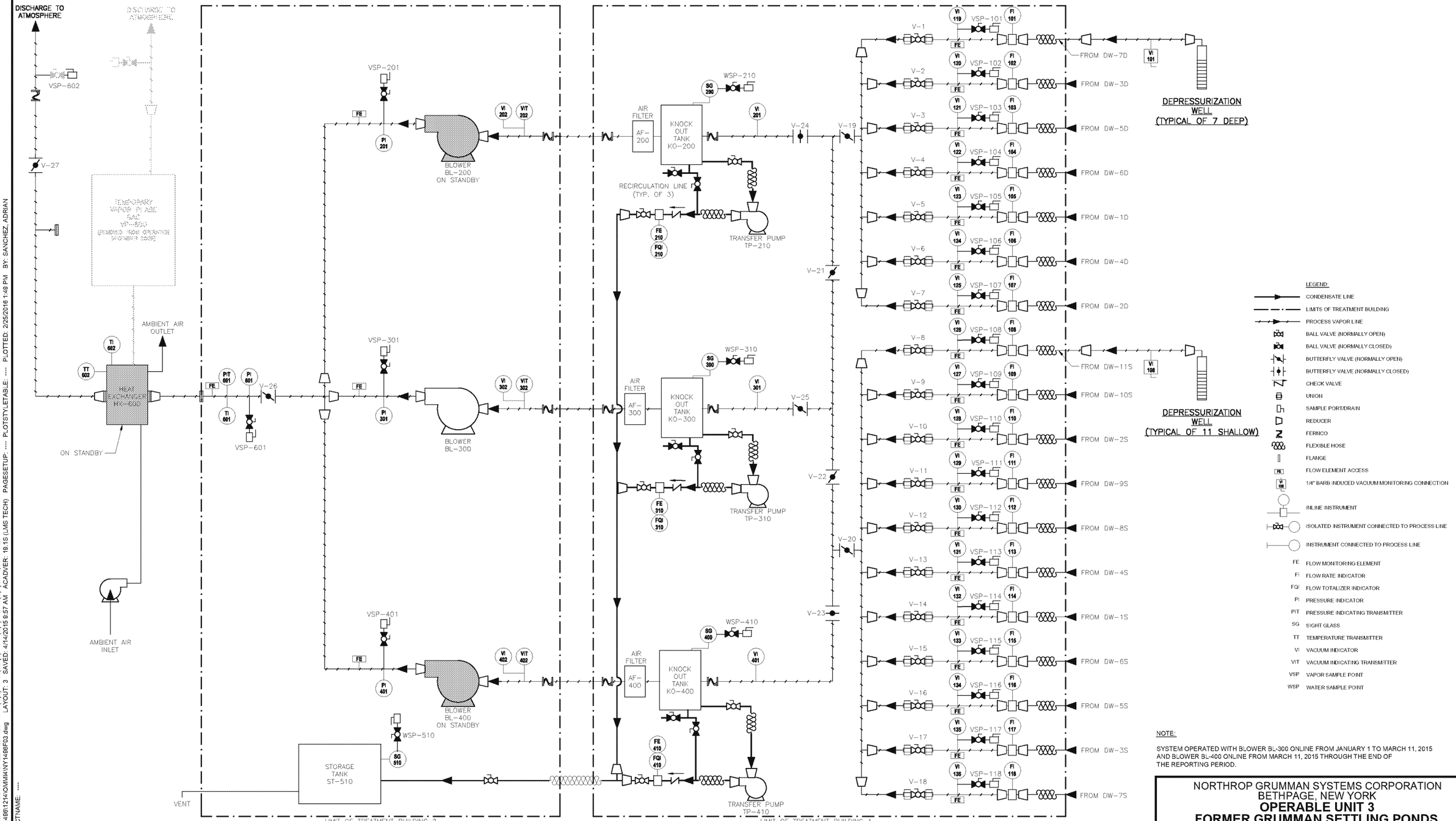
FIGURE 2



NOTE:

SYSTEM OPERATED WITH BLOWER BL-300 ONLINE FROM JANUARY 1 TO MARCH 11, 2015 AND BLOWER BL-400 ONLINE FROM MARCH 11, 2015 THROUGH THE END OF THE REPORTING PERIOD.

NORTHROP GRUMMAN SYSTEMS CORPORATION
BETHPAGE, NEW YORK
OPERABLE UNIT 3
FORMER GRUMMAN SETTLING PONDS

PROCESS FLOW DIAGRAM BETHPAGE PARK SOIL GAS CONTAINMENT SYSTEM

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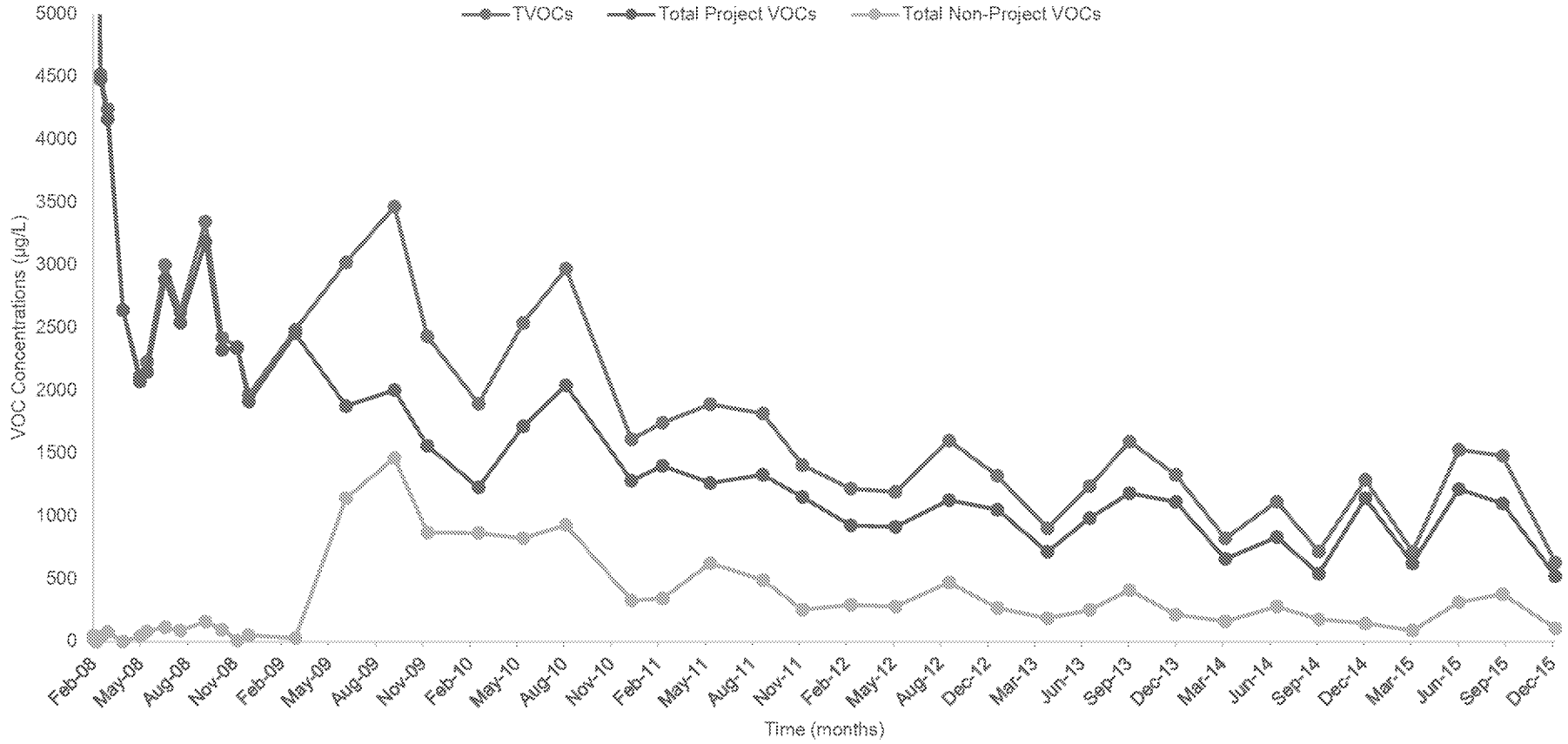
FIGURE 3

CITY:SYRACUSE-NY DIV/GROUP:ENV DB:A.SANCHEZ LD:ALS PIC:(Opt) PM:(Reqd) TM:(Opt) LYR:(Opt)ON=*;OFF=*REF*
Z:\ENVCAD\SYRACUSE\ACT\NY60148612140\MM\NY148F03.dwg LAYOUT: 3 SAVED: 4/14/2015 9:57 AM ACADVER: 18.1S (LMS TECH) PAGESETUP: ----
XREFS: IMAGES: PROJECTNAME: ----
XFBDR-DL



Notes:

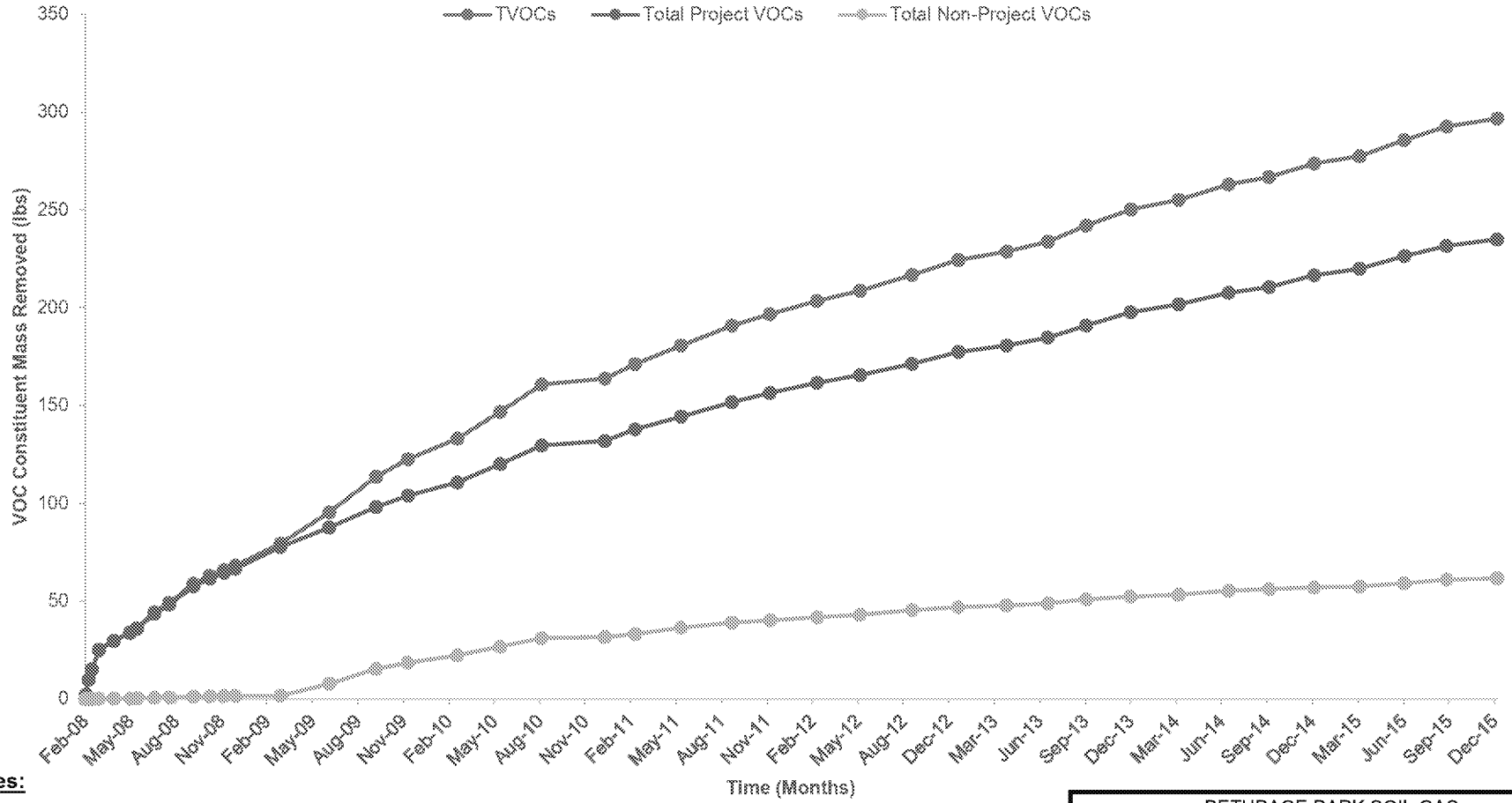
µg/L = micrograms per liter.
TVOCs = Sum of VOCs detected.
VOC = Volatile organic compound.
Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.
Non-Project VOCs = Sum of VOCs that are not Project VOCs.
1. Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 18, 2008 - 20,622 µg/L, February 19, 2008 - 14,519 µg/L, and February 25, 2008 - 8,196 µg/L.
2. The sample results from December 3, 2010 were not consistent with historical data and is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/L and is provided in Table 3 and Appendix A.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

SOIL GAS VOC CONCENTRATIONS THROUGH DECEMBER 2015

ARCADIS

FIGURE
4



Notes:

µg/L = micrograms per liter.

TVOCs = Sum of VOCs detected.

VOC = Volatile organic compound.

Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.

Non-Project VOCs = Sum of VOCs that are not Project VOCs.

1. The sample results from December 3, 2010 were not consistent with historical data and thus, the recovery rate is not included in this table. The samples results from December 3, 2010 are provided in Table 3 and Appendix A.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

CUMULATIVE TOTAL, PROJECT, AND NON-PROJECT VOC MASS REMOVED THROUGH DECEMBER 2015

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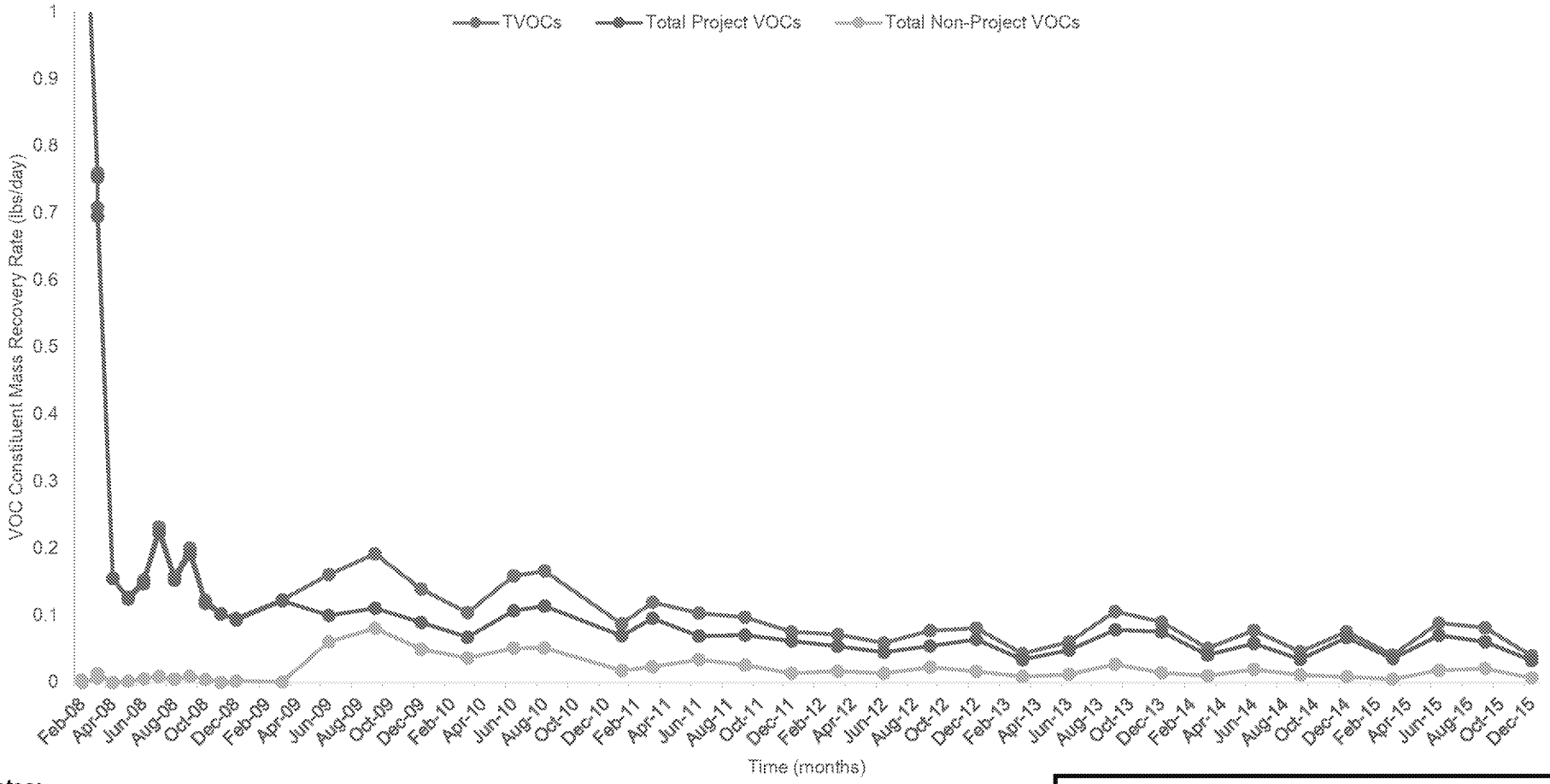
FIGURE
5



Notes:

µg/L = micrograms per liter.
TVOCs = Sum of VOCs detected.
VOC = Volatile organic compound.
Project VOCs = Sum of 1,1,1-trichloroethane; 1,1-dichloroethane; 1,2-dichloroethane; 1,1-dichloroethene; tetrachloroethene; trichloroethene; vinyl chloride; cis-1,2-dichloroethene; trans-1,2-dichloroethene; benzene; toluene; and total xylenes.
Non-Project VOCs = Sum of VOCs that are not Project VOCs.
1. Results prior to March 3, 2008 are not shown to improve figure clarity. The TVOC concentrations and sample dates are as follows: February 19, 2008 - 2.2 lbs/day and February 25, 2008 1.3 lbs/day.
2. The sample results from December 3, 2010 were not consistent with historical data and thus the recovery rate is not included in this figure. The TVOC concentration for December 3, 2010 was 13 µg/L and is provided in Table 3 and Appendix A.

BETHPAGE PARK SOIL GAS
CONTAINMENT SYSTEM, OPERABLE UNIT 3
(FORMER GRUMMAN SETTLING PONDS)
BETHPAGE, NEW YORK

VOC MASS RECOVERY RATES THROUGH DECEMBER 2015

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FIGURE
6

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